

Implementations of Herbrand's Theorem

Exercises

1 Gilmore's Method

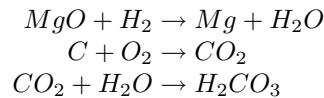
Exercise 1. Apply Gilmore's method to the following formulæ, and try to decide their satisfiability:

1. $(\neg p \vee q) \wedge \neg q \wedge p$
2. $(p \vee q) \wedge (r \vee q) \wedge \neg r \wedge \neg q$
3. $p \wedge q \wedge r$
4. $(p \vee q) \wedge (\neg p \vee q) \wedge r$
5. $(p \vee q) \wedge \neg q$
6. $(p \vee q) \wedge (\neg p \vee q) \wedge (\neg r \vee \neg q) \wedge (r \vee \neg q)$

2 The method of Davis-Putnam

Exercise 2. Apply the method of Davis-Putnam to the six formulæ above, and try to verify if their are satisfiable.

Exercise 3. Consider the following chemical reactions



and suppose there is a sufficient amount of MgO , H_2 , O_2 , and C . Show, by means of the method of Davis-Putnam, that we can make H_2CO_3 .

Exercise 4. Prove, by Davis-Putnam, that the following formula is *valid*.

$$(((q \rightarrow p) \wedge (p \rightarrow q)) \rightarrow (\neg q \wedge \neg r)) \vee (((r \rightarrow p) \wedge (q \rightarrow s)) \rightarrow ((p \rightarrow r) \rightarrow (r \wedge s)))$$

3 The Resolution method of Robinson

Exercise 5. Prove the following set of clauses is unsatisfiable by ground resolution:

$$\{p \vee q \vee r, \neg p \vee r, \neg q, \neg r\}$$

Exercise 6. For the set $S = \{p \vee q, \neg q \vee r, \neg p \vee q, \neg r\}$ derive an empty clause from S by ground resolution.